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**SOLAR OBSERVATIONS**

**SOLAR AND SKY RADIATION MEASUREMENTS DURING SEPTEMBER, 1930**

By HERBERT H. KIMBALL

For reference to descriptions of instruments and exposures, and an account of the method of obtaining and reducing the measurements, the reader is referred to this volume of the REVIEW, page 26.

Table 1 shows that solar radiation intensities averaged close to the normal intensity for September at Madison, Wis., and Lincoln, Nebr., and slightly below normal at Washington, D. C.

Table 2 shows an excess in the total solar radiation received on a horizontal surface directly from the sun and diffusely from the sky at all stations except Fresno for which normals have been computed. The excess was marked at Washington, Madison, New York, and La Jolla.

Skylight polarization measurements obtained at Washington on 4 days during the month give a mean of 47 per cent and a maximum of 50 per cent on the 23d. At Madison measurements obtained on 15 days give a mean of 60 per cent and a maximum of 70 per cent on the 17th. The values for Washington are decidedly below, and those for Madison only slightly below, the corresponding September averages for the respective stations.

TABLE 1.—Solar radiation intensities during September, 1930

[Gram-calories per minute per square centimeter of normal surface]

Washington, D. C.												
Sun's zenith distance												
Date	8 a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	87.7°	Noon	Local mean solar time
	75th mer. time	Air mass										
		A. M.					P. M.					
	e.	5.0	4.0	3.0	2.0	1.0	2.0	3.0	4.0	5.0	e.	
	mm.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	mm.	
Sept. 4	9.47	0.67	0.80	0.94								7.29
Sept. 6	16.79					1.16						10.21
Sept. 9	11.81	0.46	0.53	0.56								9.47
Sept. 11	11.81	0.56	0.66	0.82	1.02							10.59
Sept. 22	13.13				0.86							12.68
Sept. 23	14.10		0.42	0.62	0.75	0.97						11.81
Sept. 26	16.79	0.73	0.86	0.98	1.09							15.11
Sept. 29	5.36	0.81	0.92	1.02	1.24							4.75
Sept. 30	6.50				0.94	1.15	1.18	0.85	0.67	0.56		6.02
Means		0.65	0.70	0.82	0.98	1.09	(1.18)	(0.85)	(0.67)	(0.56)		
Departures		-0.04	-0.05	-0.05	-0.07	-0.23	+0.13	+0.00	-0.06	-0.10		

TABLE 1.—Solar radiation intensities during September, 1930—Con.

Madison, Wis.

Madison, Wis.												
Sun's zenith distance												
Date	8 a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	87.7°	Noon	Local mean solar time
	75th mer. time	Air mass										
		A. M.					P. M.					
	e.	5.0	4.0	3.0	2.0	1.0	2.0	3.0	4.0	5.0	e.	
	mm.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	mm.	
Sept. 2	12.68					1.38	1.28					10.97
Sept. 3	7.87	0.80	0.92	1.06	1.24	1.39	1.18					6.76
Sept. 4	9.83				1.14							9.81
Sept. 8	9.14				0.99							7.29
Sept. 9	9.83				1.08	1.31						8.18
Sept. 10	10.59						0.91					7.87
Sept. 11	9.47				1.00		0.97					9.47
Sept. 12	11.38						0.73					15.11
Sept. 16	8.48		0.86	0.97	1.17		1.20					6.02
Sept. 17	6.02		0.98	1.10	1.28	1.48	1.26					6.76
Sept. 18	7.29			0.99	1.17	1.39	1.06					8.18
Sept. 19	11.38				0.97	1.32						13.13
Sept. 20	5.36				1.30	1.52						4.17
Sept. 22	7.87				1.16		1.11					7.87
Sept. 23	13.61				1.05							15.65
Sept. 27	4.57				1.28							4.75
Sept. 29	1.95						1.21					6.02
Sept. 30	5.16		1.06	1.17	1.32							4.57
Means		(0.80)	0.96	1.06	1.15	1.40	1.09					
Departures		-0.08	+0.05	+0.04	-0.01	+0.03	-0.06					

Lincoln, Nebr.

Lincoln, Nebr.												
Sun's zenith distance												
Date	8 a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	87.7°	Noon	Local mean solar time
	75th mer. time	Air mass										
		A. M.					P. M.					
	e.	5.0	4.0	3.0	2.0	1.0	2.0	3.0	4.0	5.0	e.	
	mm.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	mm.	
Sept. 2	8.48					1.38	1.16	0.97	0.81	0.70		7.87
Sept. 3	9.47		0.81	0.82	1.00							10.59
Sept. 5	11.81			0.74	0.98							14.60
Sept. 13	14.60		0.81	0.90	1.11	1.35						15.11
Sept. 15	8.81					1.41	1.21	0.99	0.90	0.74		7.29
Sept. 16	8.81		0.90	1.06								6.02
Sept. 17	7.04	0.84	0.94	1.06	1.21	1.46	1.16	0.97	0.79	0.69		7.04
Sept. 18	10.59		0.74	0.88	1.10	1.43						9.83
Sept. 19	9.47						1.02	0.89	0.72	0.63		9.14
Sept. 22	9.83			0.86	1.07							13.13
Sept. 27	7.04				1.23	1.44	1.25	1.05	0.88	0.76		4.37
Sept. 28	5.79						1.25	1.06	0.90	0.77		4.17
Sept. 29	6.27		0.85	0.95	1.13		1.09	0.91	0.76	0.65		8.81
Sept. 30	5.16		0.84	0.99	1.20	1.43						4.57
Means		(0.84)	0.84	0.92	1.11	1.41	1.16	0.98	0.82	0.71		
Departures		+0.08	-0.02	-0.08	-0.07	+0.01	+0.01	+0.01	-0.01	-0.02		

<sup>1</sup> Extrapolated.

TABLE 2.—Total solar radiation (direct+diffuse) received on a horizontal surface

Week beginning	Average daily totals									
	Washington	Madison	Lincoln	Chicago	New York	Pittsburgh	Gainesville	Fresno	La Jolla	Miami
1930										
Sept. 3	404	396	307	302	352	366		546	455	428
Sept. 10	390	411	399	292	253	318	360	545	333	462
Sept. 17	404	430	456	320	377	355	427	457	327	517
Sept. 24	438	306	401	216	288	294	427	410	312	487
	Departures from weekly normals									
Sept. 3	+26	+23	-109	-8	+51			-19	+110	
Sept. 10	+15	+66	-7	+5	-44			+13	+36	
Sept. 17	+50	+86	+68	+50	+95			-35	+21	
Sept. 24	+62	+15	+57	-19	+29			-44	-38	
Accumulated departure on Sept. 30	+5,957	+1,708	-1,841	+861	+896			-2,304	-2,030	

POSITIONS AND AREAS OF SUN SPOTS

[Communicated by Capt. J. F. Hellweg, Superintendent United States Naval Observatory. Data furnished by Naval Observatory, in cooperation with Harvard, Yerkes, Perkins, and Mount Wilson Observatories. The differences of longitude are measured from central meridian, positive west. The north latitudes are plus. Areas are corrected for foreshortening and are expressed in millionths of sun's visible hemisphere. The total area, including spots and groups, is given for each day in the last column]

Date	Eastern stand-ard civil time	Heliographic			Area		Total area for each day
		Diff. long.	Longi-tude	Lati-tude	Spot	Group	
1930							
Sept. 1 (Naval Observatory)	h m 11 59	° -79.0	° 84.4	° +5.0	40	68	
		-15.5	147.9	+9.5	6		
		-13.5	149.9	-13.5			
		+25.0	188.4	+7.5	15		
		+37.5	200.9	-10.0	28	157	
Sept. 2 (Naval Observatory)	10 51	-74.5	76.3	-8.0	93		
		-65.5	85.3	+5.0		62	
		-2.0	143.8	+9.0	46		
		-0.5	150.3	-13.0	6		
Sept. 3 (Naval Observatory)	10 11	+51.5	202.3	-10.0		18	225
		-79.0	59.0	-16.5	28		
		-61.5	76.5	-7.0	108		
		-53.5	84.5	+5.0	31		
		9.5	128.5	+5.0		43	
		+10.5	148.5	+9.0	40		
		+12.5	150.5	-13.0	6		
		+65.0	203.0	-10.0		15	271
Sept. 4 (Naval Observatory)	10 55	-84.0	35.4	+16.5	231		
		-63.5	60.9	17.0		62	
		-48.0	76.4	-7.0	68		
		-39.0	85.4	+5.0	6		
		+6.0	130.4	+5.0		185	
		+24.5	148.9	+9.5	37		
		+24.5	148.9	-11.0	2		591
Sept. 5 (Naval Observatory)	12 50	-71.5	38.6	+16.0	278		
		-51.0	59.1	-17.5		49	
		-33.5	76.6	-7.5	65		
		-29.5	80.6	+5.5	9		
		+21.0	131.1	+5.0		201	
		+38.5	148.6	+9.5	31		633
Sept. 6 (Naval Observatory)	10 40	-59.5	38.6	+16.0	262		
		-38.5	59.6	-17.5	15		
		-21.0	77.1	-7.5	65		
		-17.5	80.6	+6.0	6		
		+8.5	106.6	-3.5		9	
		+33.0	131.1	+3.0		247	
		+45.0	143.1	-13.0	15		
		+51.0	149.1	+9.5	31		650
Sept. 7 (Naval Observatory)	11 9	-24.0	38.1	+16.0	170		
		-24.0	60.6	-17.0		3	
		-8.0	76.6	-7.5	62		
		-0.5	84.1	+6.0		15	
		+22.5	107.1	-4.5	3		
		+36.5	121.1	-11.5	3		
		+49.0	133.6	+4.5		231	
		+64.5	149.1	+9.5	9		496
Sept. 8 (Naval Observatory)	12 36	-33.0	37.6	+16.5	185		
		+6.0	76.6	-7.5	56		
		+15.0	85.6	+5.5		15	
		+50.5	121.1	-11.5	9		
		+63.5	134.1	+5.0		170	435

POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern stand-ard civil time	Heliographic			Area		Total area for each day
		Diff. long.	Longi-tude	Lati-tude	Spot	Group	
1930							
Sept. 9 (Naval Observatory)	h m 10 44	° -21.0	° 37.5	° +16.0	247		
		+18.5	77.0	-8.0	46		
		+28.5	87.0	+5.5	6		
		+78.0	136.5	+4.5	185		484
Sept. 10 (Naval Observatory)	11 37	-77.5	327.3	-10.5		18	
		-8.0	36.8	+16.0	231		
		+32.0	76.8	-8.0	34		
		+34.5	79.3	+4.0	3		286
Sept. 11 (Naval Observatory)	10 39	-60.5	331.6	-11.0	15		
		+4.5	36.6	+16.0		231	
		+45.0	77.1	-8.0	34		
		+68.0	100.1	-10.0		37	317
Sept. 12 (Mount Wilson)	11 10	-48.0	330.5	-11.0	6		
		+19.0	37.5	+18.0		303	
		+60.0	78.5	-8.0	7		316
Sept. 13 (Naval Observatory)	10 31	-75.5	290.3	-12.0		93	
		-39.0	326.8	-11.0	6		
		+32.0	37.8	+16.0		185	
		+39.0	44.8	-9.5		12	296
Sept. 14 (Naval Observatory)	11 24	-60.5	291.6	-11.5		46	
		+45.5	37.6	+16.0		139	
		+54.5	46.6	-9.0	6		191
Sept. 15 (Naval Observatory)	10 44	-47.5	291.7	-11.5		18	
		+58.5	37.7	+16.5		37	55
Sept. 16 (Naval Observatory)	10 43	-33.5	292.5	-11.5		15	15
Sept. 17 (Naval Observatory)	10 40	-19.5	293.4	-11.5		12	12
Sept. 18 (Naval Observatory)	11 9				(?)	(?)	
Sept. 19 (Naval Observatory)	13 11	-15.5	269.6	+16.5	3		
		+3.0	288.1	-19.5		6	9
Sept. 20 (Naval Observatory)	10 42	-3.5	269.8	+16.5		9	9
Sept. 21 (Naval Observatory)	10 53	+9.5	269.5	+16.5		6	6
Sept. 22 (Naval Observatory)	10 41	-11.5	235.4	+18.0		31	31
Sept. 23 (Naval Observatory)	10 41	+2.0	235.7	+18.0		15	15
Sept. 24 (Naval Observatory)	10 40	-85.5	135.0	+6.0	185		
		+14.5	235.0	+18.5		12	197
Sept. 25 (Naval Observatory)	10 40	-71.0	136.3	+6.0	170		
		+28.5	235.8	+18.5		31	201
Sept. 26 (Naval Observatory)	10 42	-78.5	115.6	-3.0	123		
		-60.0	134.1	-24.5		9	
		-58.5	135.6	+6.0	139		
		+41.0	235.1	+18.0		56	327
Sept. 27 (Naval Observatory)	10 59	-64.5	116.2	-2.5	139		
		-44.5	136.2	+6.0	108		
		+56.0	236.7	+18.0		77	324
Sept. 28 (Naval Observatory)	10 49	-51.5	116.1	-2.5	123		
		-31.5	136.1	+6.0	123		
		+70.0	237.6	+17.5		25	271
Sept. 29 (Naval Observatory)	10 56	-37.5	116.8	-3.0	139		
		-18.5	135.8	+6.5	123		262
Sept. 30 (Naval Observatory)	10 42	-24.0	117.3	-3.5	139		
		-5.0	136.3	+6.0	123		262
Mean daily area for September							245

1 No spots

PROVISIONAL SUN-SPOT RELATIVE NUMBERS FOR SEPTEMBER, 1930<sup>1</sup>

[Data furnished through the courtesy of Prof. W. Brunner, University of Zurich, Switzerland]

September, 1930	Relative numbers	September, 1930	Relative numbers	September, 1930	Relative numbers
1	d 56	11	a 39	21	8
2	a 46	12	33	22	Mc 10
3	Mc 48	13	39	23	
4	ad 68	14	23	24	d 18
5	66	15	28	25	19
6	73	16	17	26	d 35
7	70	17	8	27	33
8	a 41	18	0	28	31
9	40	19	7	29	26
10	41	20	6	30	a 20

Mean (29 days) = 32.7.

<sup>1</sup> Dependent alone on observations at Zurich and its station at Arosa.  
a Passage of an average-sized group through the central meridian.  
c New formation of a large or average-sized center of activity: E, on the eastern part of the sun's disk; W, on the western part; M, in the central zone.  
d = Entrance of a large or average-sized center of activity on the east limb.